4.0 V&V STATUS AND USAGE HISTORY

This portion of ASP-I summarizes applications employing BRAWLER and the extent to which those applications have been supported by documented verification and validation (V&V). Details of the assessment procedures for V&V Status and Usage History can be found in the Standardized Verification, Validation, and Configuration Management Processes Description (Draft), China Lake, CA, NAWCWPNS, January 1995. Information on prior accreditations of the model is also provided in the paragraphs below.

BRAWLER has a large number of users with a wide variety of applications. The Users Group Points of Contact (POCs) Listing in Appendix C includes 114 individual entries from approximately 63 government organizations and commercial firms doing government business. A breakdown of these groups by DoD service is found in Table 4-1 below. The user of BRAWLER seeking information to support accreditation should realize a sense of community acceptance of model results given this large and diverse number of users.

TABLE 4-1. BRAWLER Users by Category.

User Category	Number
Air Force	21
Army	0
Navy	9
Other DoD	2
Other Govt.	1
Federally Funded Research and Development Centers (FFRDC)	4
Commercial Firms	26
TOTAL	63

In 1995, a questionnaire was sent to the BRAWLER user community seeking information about the use and V&V of BRAWLER. This survey was carried out, in part, because of the lack of formal V&V documentation. For BRAWLER, 30 completed questionnaires have been received containing responses from 59 individuals and 27 organizations. Table 4-2 summarizes the results by question.

TABLE 4-2. BRAWLER Users Group Survey Results.

Brief Form of Question	YES Response
Perform any Verification analysis?	21
Perform any Validation analysis?	14
Perform any sensitivity analysis?	8
Accredited?	6
Results compared with other models?	9
Results compared with test data?	6
Problems, errors, or weaknesses?	19
Developed in-house documentation	8

Many respondents provided information regarding the types of V&V activities they have used in conjunction with their use of BRAWLER. These activities are detailed in Table 4-3, and also indicated is whether or not they produced documentation of the activity results. If they found problems with BRAWLER or have knowledge of BRAWLER accreditation, it is also presented.

TABLE 4-3. Specific Results of Survey and Follow-up.

Name/Version	Verification	Validation	Accreditation	Problems Found
ASC/YC (C17-SPO) Eric Abell (513) 255-2189 (V6.15)	Direct Code Inspection, Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, Documentation Comparison to Reference Material, Comparison of Model Output or Intermediate Calculation, Documentation Produced	Comparison with other Model Results - AASPEM and MIL-AASPEM (Air-to-air System Performance Evaluation Model), Sensitivity Analysis, No Documentation	Yes	Yes
AFSAA/SAGW Maj Eileen Bjorkman (703) 697-5677 (V6.15/BETA 6.2)	Direct Code Inspection, Comparison of Input Data to Intelligence Data, Comparison of Model Output or Intermediate Calculation, No Documentation	Bench/Lab Test Data, Range/Field Test data, Comparison with other Model Results, Documentation Produced	No	No
Sverdrup Technology Inc. Tim Coons (513) 255-4343 (V1.1, V5.1, V6.1, V6.12, V6.14, V6.15)	Direct Code Inspection, Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, Documentation Comparison to Reference Material, Comparison of Model Output or Intermediate Calculation, No Documentation	Bench or Lab Test Data, Range or Field Test data, Comparison with other Model Results, Sensitivity Analysis, No Documentation	Yes	Yes
WL/FIGD Capt. Dawson-Townsend (513) 255-3949 (V6.15)	Direct Code Inspection, Comparison of Input Data to Intelligence Data, No Documentation	Other - Intelligence Data Comparison, No Documentation	No	No
Decision Science Applications (DSA) Dr. Gary Eiserman (703) 243-2500 (All Versions) Note: Model Developer	Direct Code Inspection, Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, Documentation Comparison to Reference Material, Comparison of Model Output or Intermediate Calculation, Documentation Produced	Range or Field Test data, Comparison with other Model Results, Other - Manned Simulator, Sensitivity Analysis, Documentation Produced	Yes	Yes

TABLE 4-3. Specific Results of Survey and Follow-up. (Contd.)

Name/Version	Verification	Validation	Accreditation	Problems Found
Lockheed Martin Aeronautical System Kenneth Goetz (770) 494-9115 (V6.14)	Direct Code Inspection, Comparison of Input Data to Intelligence Data, Comparison of Model Output or Intermediate Calculation, No Documentation	Range or Field Test data, Comparison with other Model Results, Sensitivity Analysis, No Documentation	No	Yes
Northrop Grumman Corp Advanced Technology and Development Center Leonard Gorospe (310) 942-6905 (V6.15)	Direct Code Inspection, Comparison of Input Data to Intelligence Data, Comparison of Model Output or Intermediate Calculation, No Documentation	Comparison with other Model Results, Sensitivity Analysis, No Documentation	No	Yes
RAND Corporation Jeff Hagen (310) 393-0411 x 6707 (V6.14a/V6.15)	Direct Code Inspection, Comparison of Input Data to Intelligence Data, Comparison of Model Output or Intermediate Calculation, Documentation Produced	Sensitivity Analysis, No Documentation Produced	No	Yes
Texas Instruments Joanne Heath (214) 575-6661 or 5046 (V6.2/V6.15)	Direct Code Inspection, Documentation Comparison to Reference Material, Comparison of Model Output or Intermediate Calculation, Documentation Produced	Comparison with other Model Results, Sensitivity Analysis, No Documentation	Yes	Yes
497IG/INOA Bruce Herndon (703) 681-4770 (V6.15)	Direct Code Inspection, Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, Documentation Comparison to Reference Material, No Documentation	No	No	No
NAIC/TAAE Tim Kanoy (513) 257-2404 (V6.13/V6.15)	Direct Code Inspection, Comparison of Input Data to Intelligence Data, Documentation Comparison to Reference Material, Comparison of Model Output or Intermediate Calculation, Documentation Produced	Comparison with other Model Results - TRAP AVENGER, Documentation Produced	No	Yes

TABLE 4-3. Specific Results of Survey and Follow-up. (Contd.)

Name/Version	Verification	Validation	Accreditation	Problems Found
Institute for Defense Analysis (IDA) Antonio Marra Jr. (703) 845-2443 (V6.1 thru V6.15)	Direct Code Inspection, Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, No Documentation	No	No	Yes
ASC/YFE(X) Gary Martin (513) 255-0312 X 2556 (V1.1/V6.14)	Comparison of Input Data to Intelligence Data, Comparison of Model Output or Intermediate Calculation, No Documentation	Sensitivity Analysis, No Documentation	No	Yes
Lockheed Advanced Development Center John Mayer (805) 572-7029 (V6.14)	Direct Code Inspection, Comparison of Input Data to Intelligence Data, Comparison of Model Output or Intermediate Calculation,Documentation Produced	Comparison with other Model Results, No Documentation	No	Yes
Northrop Grumman Commercial Aircraft Waren Robb (214) 266-8689 (V1.1 and V6.15)	Direct Code Inspection, Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, No Documentation	Range or Field Test Data, No Documentation	No	Yes
MIT Lincoln Laboratory Dr. Martin Ryba (617) 981-3546 (V6.15)	Direct Code Inspection, Code Comparison to Reference Material, Documentation Comparison to Reference Material, Comparison of Model Output or Intermediate Calculation, Documentation Produced	Comparison with other Model Results, Documentation Produced	No	Yes
ASC/XRES Lawrence Taranto (513) 255-4358 (V6.15)	Direct Code Inspection, Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, Documentation Comparison to Reference Material, Comparison of Model Output or Intermediate Calculation, No Documentation	No	Yes	Yes
SAIC James Terry (505) 766-5044 (V6.15)	Direct Code Inspection, No Documentation	Other - Comparison with MITL Simulation, Sensitivity Analysis, No Documentation	No	Yes

TABLE 4-3. Specific Results of Survey and Follow-up. (Contd.)

Name/Version	Verification	Validation	Accreditation	Problems Found
NASC Jim Williams (703) 604-3380 x 8121 (V6.0 to V6.15)	Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, Documentation Comparison to Reference Material, Comparison of Model Output or Intermediate Calculation, Documentation Produced	No	Yes	Yes
Lockheed Martin Tactical Aircraft Systems Ken Wilson (817) 935-4059 (All version thru V6.14)	Direct Code Inspection, Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, Comparison of Model Output or Intermediate Calculation, Documentation Produced	Bench or Lab Test Data, No Documentation	No	Yes
Lockheed Thomas Wooldridge (817) 763-2074 (V6.15)	Direct Code Inspection, Code Comparison to Reference Material, Comparison of Input Data to Intelligence Data, Documentation Comparison to Reference Material, Comparison of Model Output or Intermediate Calculation, No Documentation	No	No	Yes

Nearly two-thirds (63 of 102) of the analysts on record with SURVIAC performing air-to-air analysis use BRAWLER the remaining 39 use some version of AASPEM. Of these, two-thirds (21) responded with indications of performing some form of V&V, six of whom reported knowledge of accreditation actions. Nine (9) respondents indicated they produced documentation regarding verification activities while only four (4) indicated they produced documentation on validation activities.

4.1 V&V STATUS

There have been very few formal BRAWLER-specific V&V efforts over the years and even fewer have documentation available to official users. The paragraphs which follow identify the most prominent of those efforts. Note that many of the projects described below are not classical V&V efforts. Rather, they are studies which involved comparison of BRAWLER results with field test data and/or output from other models. Because of these comparisons, the studies are categorized as V&V efforts.

The following section summarizes survey responses and telephone conversations with POCs who submitted completed surveys cited in Section 4.0. The survey reflects work

completed in 1995. Additional work has been done since then and contact information may be out of date; however, the information presented here should give the user confidence in the number of users and the recent VV&A work they have performed using the model. Entries below have been placed in inverse chronological order.

a. ASC/YC (C17-SPO), Eric Abell, (513) 255-2189: BRAWLER V6.15 was used. Tests were conducted on the F-22 for trade-offs of various design features (i.e., radar range and field of regard, weapons load, radar cross-section, sustained "G", gun range, etc.)

b. AFSAA/SAGW, Maj Eileen Bjorkman, (703) 697-5677: BRAWLER V6.15 and BETA 6.2 versions used. The model was used in Advanced Medium Range Air-to-Air Missile (AMRAAM) Pre-Planned Product Improvement (P3I), F-22 studies to evaluate comparable combat effectiveness of various weapons systems, primarily missiles and aircraft. Validation analysis documentation: "BRAWLER comparison with AMRAAM Simulation Program (ASP)", Sverdrup (Matthew Shannon & Randy Stratton), TEAS Ref# 9400640-70C, dated 30 March 94, Eglin AFB, FL. Sponsors: ASC/YAX(AMRAAM System Program Office (SPO)) 207 West D Ave, Suite 303, Eglin AFB, FL 32542-6844. POC: Lt. Col. Lockhart. Sverdrup compared two sets of provided data to examine the thrust profile and the trajectory shaping algorithm to validate BRAWLER. For additional information, contact Lt. Col. Marty Allen.

c. Sverdrup Technology Inc., Tim Coons, (513) 255-4343: Extensive use over a 10-year period. Three years at ASD, two at Martin Marietta with Infrared Search and Track (IRST) devices, two years doing code modifications and studies at DSA, and five years of studies for ASD (now ASC). Weapons, aircraft, and systems include: F-15, F-16, Advanced Tactical Fighter (ATF)/F-22/F-23, Navy Tactical Fighter (experimental aircraft) (AX), Multi-role Fighter (MRF), Joint Advanced Strike Technology (JAST), AMRAAM, Advanced Air-to-Air Missile (AAAM), Variable Flow Ducted Rocket (VFDR), Air-Intercept Missile (AIM)-9X, Electro Optical Search System (EOSS)(IRST), Sensor Requirements, Radar Warning Receiver (RWR), Electronic Counter Measures (ECM), and TACIT RAINBOW.

d. WL/FIGD, Capt. Tim Dawson-Townsend, (513) 255-3949: BRAWLER V6.15. The Vista Advanced Capabilities Simulation (VACS) project is hoping to extract BRAWLER Infrared (IR) signature algorithms for use in real-time simulation.

e. Decision-Science Applications, Inc., Dr. Gary Eiserman (703) 243-2500, Dr. Earl Lazarus, Dan Croghan, and Al Gordon: All model versions have been used since its development in 1977. Model development and maintenance, development of input data sets, user support, study support, both in-house and off-site. Table 4-4 contains BRAWLER studies from AFSAA files.

TABLE 4-4. BRAWLER Studies at AFSAA.

Date	Title	BRAWLER Areas Examined/Problems
8-93	AIM-9X Operational Requirements Assessment/Cost & Operational Effectiveness Analysis (COEA)	Validated short range missile (SRM) model against detailed flyouts. Problem found in minimum range determination, where BRAWLER ranges tended to be too short
1-92	Analysis of Short Range missile Concepts Using BRAWLER and Man-in-the-Loop	BRAWLER exchange ratios correlated well with dome simulation results and were within the process variance
9-91	Effectiveness of Short Range Missiles in an Operational Environment	Studies effects of seeker capability, missile maneuverability, helmet mounted sight, missile kinematic range, and off-boresight capability
1-89	Air to Air Combat Identification Study	Modeled electronic and visual ID combat rules of engagement (ROEs) as well as airspace control procedures
6-88	F-16 Derivatives	Operation effectiveness study of defensive counter-air (DCA) and close-in combat (CIC) engagements

f. Northrop Grumman Corporation Advanced Technology & Development Center, Air/Strike Warfare Analysis, Leonard Gorospe (310) 942-6905: BRAWLER V6.15 is used. Table 4-5 contains programs and tasks where BRAWLER sensitivity analyses was performed and the specific areas examined.

TABLE 4-5. BRAWLER Sensitivity Analyses at Northrop.

Program	Tasks	BRAWLER Areas Examined
JAST	Defensive Counter Air	Radar Detection Range, Speed, RCS, Weapon Loading, Threat
	Offensive Counter Air	Radar Detection Range, Speed, RCS, Weapon Loading, Threat, Pilot Tactics
	Acceleration	Weapon Parameters, Maximum Speed, Threat
	Joust	Weapon Parameters, Detection Range, Threat, RCS
B-2		Pilot Tactics
F-5	Marketing	Weapon Parameters, Detection Range, Threats, RCS
Independent Research and Development (IRAD)	Autonomous Cooperative Operations Study (ACOS)	Pilot Tactics, Communication Links, Airborne Warning & Control System (AWACS)
	Air-to-Ground BRAWLER	Pilot Tactics, Air-to-Ground Sensors, Surface-to-Air Missiles (SAM), Surface-to-Surface Missiles (SSM)
Other	VV&A	Fuel Flow, Thrust, RWR, Countermeasures, Missile Launch Envelopes, Pilot Vision, Radar, Clutter, IRST, Gun Model, Pilot Tactics, SAMs, SSMs, RCS, Aero performance

g. RAND Corporation, Jeff Hagen, Don Stevens, Gary Liberson, and Carol Johnson, (310) 393-0411 x6707: BRAWLER V6.14a and V6.15 versions were used. Project Air Force included studies of One vs. One and Many vs. Many analysis, Fighter vs. Cruise missile timeline and sensor analysis, and V&V. Table 4-6 contains documentation of studies done at RAND.

TABLE 4-6. BRAWLER Studies at RAND.

Date	Title	Classification	Author	BRAWLER Areas Examined
8-93	Clutter Interference Computation for Radar Seekers in BRAWLER (RAND/DRR-207-AF)	Unclassified	D.B. Novikoff J.S. Kivitky	Weapon systems computer simulation of radar in aeronautics and target acquisition
12-94	Future Air-to-Air Combat: BRAWLER Results for Comparison with Corresponding AASPEM Trials (RAND/DRR-766-AF)	SECRET NOFORN WNINTEL	Jeff Hagen	Not Available
3-95	Infrared Search and Track Modeling in the BRAWLER Code (RAND/DRR-739-AF)	Unclassified	Richard Greene	Not Available
7-92	Radio Frequency (RF) Signature and Air-to-Air Armament Tradeoffs for Multirole Fighters (WD-6123-AF)	SECRET NOFORN WNINTEL	Gary Liberson	Not Available
3-92	OSD Low Observables/Counter Low Observables: RANDs Air Superiority Study--Status Report (WD-5899-AF/PA&E)	Unclassified	(22 RAND personnel) Don Stevens, et al.	Not Available
11-94	Taming the Monster: Countering U.S. Air Power with Asymmetric Air-to-Air Strategies (RAND/DRR-833-AF)	SECRET NOFORN WNINTEL	Jeff Hagen	Air-to-air combat to examine the effectiveness of threat aircraft flying against current U.S. forces.
1-92	Analysis of Short Range Missile Concepts using BRAWLER and Man-in-the-Loop Simulations (SAKI-28490)	SECRET	Bishop Sheen	Models AIM-9X in aerial combat computer simulation
5-91	BRAWLER Analysis for the Bomber Force Structure Study (IN-25853-AF)	SECRET NOFORN WNINTEL	D.B. Novikoff	Not Available
6-90	BRAWLER Analysis for JSTARS Survivability Study (IN-25772-PA&E)	SECRET	D.B. Novikoff	Defensive measures to aid in the survivability of the JSTARS aircraft. Engagements involved JSTARS aircraft, a squad of Flankers, and defending F-15s.

h. Texas Instruments, Joanne Heath, (214)575-6661 or 5046: Version V6.15 and V6.2 (developmental) were used. Texas Instruments has used BRAWLER extensively in GEN-X, Free Fall Decoy, SAR programs, missile systems Independent Research and Development (IR&D), towed decoys, proposals, and advanced radar study. BRAWLER was used to evaluate existing TI products and conceptualized weapon systems for internal IR&D or external proposals.

Documentation on BRAWLER exists but is company proprietary and/or classified. Model changes have been made to decoys, missiles, semi-active ARM and IR, and graphic interface for 3-D display. Validation of the model was done by code comparison in a GEN-X study. "Gen-X Final Report", Michelle Calder, Feb 1995, Classified SECRET, Sponsor NAWC - Warminster, PA. Modeled GEN-X capability compared trajectory with free fall data in other models (Enhanced Surface-to-Air Missile Simulation (ESAMS) and TRAP). The ARM missile model was compared with 6DOF informally and found to be very similar. Texas Instruments has done a lot of modeling of surface-to-air weapons. An Advanced Electronic Steering Array (AESA) Radar will be incorporated in the next version of BRAWLER.

i. 497IG/INOA, Bruce Herndon, Richard Oarr, and Nick Lucas, (703) 681-4770: BRAWLER V6.15 version was used. Used to assess the relative performance of airframes and weapon systems specifically AMRAAM P3I and AIM-9X.

j. NAIC/TAAE, Tim Kanoy, (513) 257-2404: BRAWLER V6.13 and V6.15 versions were used. NAIC has been building and verifying threat data sets which are used community-wide. Validation was not formal. They would compare a missile model's performance with trap avenger. Changes to the model were for printouts or extra values, not model performance itself.

k. ASC/YFE(X) (F-22 System Program Office), Gary Martin, (513) 255-0312 x2556: BRAWLER V1.1 and V6.14 versions have been used. Used to determine F-22 air combat capability against future threat systems. Each study lasted about 6 months and included other government agencies.

l. Lockheed Advanced Development Center, John Mayer, Chuck Mason, and Bev Baughman, (805) 572-7029: BRAWLER V6.14 version was used. Model used to support claims that our weapon system can meet government requirements (i.e., kill ratios, survivability, and to design trade studies with respect to ATF, F-22, and AX). Changed Aerodynamics code so aircraft will climb at high altitude.

m. Northrop Grumman Commercial Aircraft Division, Warren Robb, (214) 266-8689: BRAWLER V1.1 through V6.15 versions have been used. The investigation of tactics, sensor and CM effectiveness, offensive and defensive capability, and system trade studies were done on various platforms including ATF-X, S-3, AEW, S-3 survivability enhancement, YA-7F, and other classified programs. Mr. Robb is no longer with the company. The new POC is Sam Herman. Version 6.01 was first version used.

n. Lockheed Martin, Warren Robb, (817) 777-2144, P.O. Box 748, Mail Zone 2655, Fort Worth, TX 76101. Mr. Robb's new job is using BRAWLER for IRST effectiveness, F-16 block upgrade effectiveness, generic aircraft effectiveness to cool engine parts to reduce IR signature.

o. MIT Lincoln Laboratory, Dr. Martin Ryba, (617) 981-3546: BRAWLER V6.15 version is being used. To evaluate fidelity of airborne radar - missile seeker models and investigate inclusion or improvement of modeling of endgame ECM. Model was modified to fix computer clutter background by radar

detection. The "formal" V&V was done in the form of a briefing. Talk-B Fighter Radar Model Assessment, Error Vehicle Survivability Workshop, 3-5 May 1995, Classified SECRET, Report Lincoln Lab Project Report, AVS-17, Vol II, pp 429-450.

p. ASC/XRES, Lawrence Taranto, (513) 255-4358: BRAWLER V1.1, V5.1, V6.1, V6.12, V6.14, and V6.15 versions were used. For JAST, base case capability assessment of current forces and RCS requirements analysis for on-going efforts. For the ATF and F-22 studies for avionics effectiveness, IR signature, nozzle study, alternatives study, and Milestone II (MSII) COEA, 1988-1992. (No documentation)

q. SAIC (AFOTEC/TFF), James Terry, (505) 766-5044 or 846-8987: BRAWLER V6.15 version was used. Determine effects of real-time kill removal on F-22 IOT&E flight test. Plan for and conduct PVST-Test analyses for F-22 IOT&E flight test. Mr. Terry wrote "Flight Test Real-Time Kill Removal Assessment Phase I Result -Annotated Briefing," 24 April 1995, Unclassified, Sponsor: AFOTEC/TFF (F-22 testing), POC Capt. Shaver. Made extensive changes to the model to simulate flight test instead of actual combat (a procedural real-time kill removal instead of actual combat kill). One significant change was in screen symbology so that a real-time kill would show up as dead immediately avoiding the significant time delay that was inherent in the original technique which did not indicate a kill on screen.

r. Naval Air Systems Command (AIR-4.10) x8121, Jim Williams, (703) 604-3380: BRAWLER V6.01, V6.02, V6.03, V6.04, V6.1, V6.11, V6.12, V6.13, V6.14, V6.14A, and V6.15 versions have been used. Projects include AIM-9X and AMRAAM P3I COEAs with Air Force counter-parts at AFSAA, JAST, and AX COEA. Model used for air-to-air effectiveness model used for Acquisition Category (ACAT) I & II and Tactical Aircraft (TACAIR) COEAs for approximately 1.5 years.

s. Lockheed Martin Tactical Aircraft Systems, Ken Wilson, (817) 935-4059: all versions from beginning through V6.14 have been used. F-16 derivatives used for evaluation of performance/avionics modifications. F-22 used for system effectiveness and evaluation of subsystem specification requirements and specification compliance. Documentation has been done on verification of the model. However, due to the classified nature of the work titles and descriptions, verification documentation could not be provided. Gary Martin at F-22 System Program Office is the POC for any further information.

t. Lockheed (TX), Thomas Wooldridge, (817) 763-2074: BRAWLER V6.15 version is being used. Studies include air combat effectiveness analysis, aircraft and avionics design study parametrics for the ATF, F-22, F-16, JAST, and special projects. Modifications included adding a backward firing missile and program specific changes.

4.2 USAGE HISTORY

Table 4-7 summarizes paragraphs summarize additional applications using BRAWLER. This table reflects the projects and purposes cited by the specific user that responded to the questionnaire. This only constitutes one-third of the listed users of BRAWLER. Undoubtedly, there are other projects and/or programs for which BRAWLER has been used. There is limited documentation available defining the studies in which users have employed BRAWLER. This is probably due to two main reasons. First, many of the studies are conducted for classified programs. Second, other studies are proprietary in nature, being used by the designers of aircraft, radar, and weapon systems. Documentation of either type of study is generally not available without special permission and/or security clearances. As the BRAWLER ASPs mature over time, more information about applications of BRAWLER could become available.

TABLE 4-7. BRAWLER Usage.

Name	Projects	Purposes
ASC/YC (C17-SPO) Eric Abell (513) 255-2189	Advanced Tactical Fighter, F-22 EMD	Trade-off Studies of various design features: RADAR Range, Field of Regard, Weapons Load, RCS, Sustained "G", Gun Range etc.
AFSAA/SAGW Maj Eileen Bjorkman (703) 697-5677	AMRAAM P3I, F-22 Studies, ASRAAM Independent Study	Evaluate comparable effectiveness of various weapon systems, primarily missiles and aircraft
Sverdrup Technology Inc. Tim Coons (513) 255-4343	F-15, F-16, ATF/F-22/F-23, AX, MRF, JAST, AMRAAM, AAAM, VFDR, AIM-9, EOSS (IRST), Sensor Requirements, RWR, ECM, Tacit Rainbow	Many Studies over 10 year period (84 - 86 at ASD, 87 - 88 IRSTs at Martin Marietta, 89 - 90 code mods and studies at DSA, 90 -94 studies for ASD/ASC)
WL/FIGD Capt. Dawson-Townsend (513) 255-3949	Vista Advanced Capabilities Simulation (VACS)	Extraction of IR signature algorithms for use in real-time simulation
Decision Science Applications (DSA) Dr. Gary Eiserman (703) 243-2500	Principal Model Developer	Model Development & Maintenance, User Support, Study Support
Rockwell - North American Aircraft Division David A.Eubanks (310) 797-3958	B-1B upgrade programs (Planned)	Evaluating effectiveness and sensitivities to upgrade options
Lockheed Martin Aeronautical System Kenneth Goetz (770) 494-9114	F-22	Trade-off Studies of various design features: RCS Impacts, Avionics Impacts, Threat Impacts, Tactics Impacts, Weight Impacts, etc.
Northrop Grumman Corp Advanced Technology and Development Center Leonard Gorospe (310) 942-6905	Advanced Lightweight Fighter, JAST, F-5, Advanced Strike Fighter, B-2	Requirements Sensitivities, Survivability, Lethality, Missile Envelope Generation, System Effectiveness

TABLE 4-7. BRAWLER Usage. (Contd.)

Name	Projects	Purposes
RAND Corporation Jeff Hagen (310) 393-0411 x 6707	Project Air Force	One vs. One and Many vs. Many Analysis, fighter vs. Cruise Missile Timeline and Sensor Analysis, VAV Survivability, etc.
Texas Instruments Joanne Heath (214) 575-6661 or 5046	GEN-X, Free Fall Decoy, SAR Programs, Missile System IR&D, Towed Decoys, Proposals, Advanced RADAR Study	Evaluate Existing TI Products and Conceptualized Weapon Systems for Internal IR&D or external proposals
497IG/INOA Bruce Herndon (703) 681-4770	AMRAAM P3I and AIM-9X	Assess the Relative Performance of Airframe & Weapon Systems
NAIC/TAAE Tim Kanoy (513) 257-2404	None	Building and Verifying Threat Data Sets for Community Use
Institute for Defense Analysis (IDA) Antonio Marra Jr. (703) 845-2443	B-1 COEA, Rapid Crisis Response, CAI COEA	Investigation of Air-to Air Issues (*Used since it carries credibility in many communities*)
ASC/YFE(X) Gary Martin (513) 255-0312 x 2556	F-22 PDR Study, Avionics Effectiveness Study, Requirements Briefings	Determine F-22 Air Combat Capability Against Future Threat Systems
Lockheed Advanced Development Center John Mayer (805) 572-7029	ATF, F-22, AX	Demonstrate Weapon System Meets Government Requirements (Kill rates, Survivability, etc.), Design Trade-off Studies, Requirements Definition/Verification.
Northrop Grumman Commercial Aircraft Waren Robb (214) 266-8689	ATF-X, S-3 AEW, S-3 Survivability Enhancement, YA-7F, and other classified programs	System Trade-off Studies, Investigate Tactics, Sensor & CM Effectiveness, Offensive & Defensive Capability
MIT Lincoln Laboratory Dr. Martin Ryba (617) 981-3546	Air Vehicle Survivability Evaluation	Evaluate Fidelity of Airborne RADAR, Missile Seeker Models, Investigate Inclusion or Improvement of Modeling Endgame ECM
Center for Naval Analysis William Steptoe (703) 989-9339	AX COEA	Comparison of Three Competing AX Designs Against 5th Generation Fighters
ASC/XRES Lawrence Taranto (513) 255-4358	JAST, AMRAAM, F-16, F-15, B-1B, AX, ATF/F-22	Base Case Capability Assessment of Current Forces and RCS Requirements Analysis (JAST), Avionics Effectiveness, IR Signature, Nozzle Study, Alternative Study, MSII COEA
SAIC James Terry (505) 766-5044	F-22	Determine the Effect of Real-Time Kill Removal on F-22 IOT&E Flight Test. Plan for and conduct Post-Test Analysis for F-22 IOT&E Flight Test.

TABLE 4-7. BRAWLER Usage. (Contd.)

Name	Projects	Purposes
NASC Jim Williams (703) 604-3380 x 8121	AIM-9X, AMRAAM P3I COEA, JAST, AX COEA	Primary Air-to-Air Effectiveness Model
Lockheed Martin Tactical Aircraft Systems Ken Wilson (817) 935-4059	F-16, F-22	Evaluate Performance and Avionics Modifications for F-16 Derivatives, Evaluate System Effectiveness and Subsystem Specifications, Requirements, and Spec Compliance for F-22 and Derivatives
Lockheed Thomas Wooldridge (817) 763-2074	ATF, F-22, F-16, JAST, Special Projects	Air Combat Effectiveness Analysis, Aircraft and Avionics Design Study Parametrics
HQ AFOTEC/SAN Capt. T. Wziontka (505) 846-2849	AIM-9X	Analyze Performance of Air-to-Air Missile, Pre-test Planning (Determine how to Conduct Open Air Test)

4.3 IMPLICATIONS FOR MODEL USE

BRAWLER has been used in many DoD studies as a primary tool for analyzing air-to-air engagement scenarios. Primary usage appears to be in the area of trade-off studies concerning comparable effectiveness of various aircraft and weapons load configurations. It has apparently been used to support acquisition decisions; demonstrating weapon system ability to meet government requirements or evaluating various upgrade options.

BRAWLER is a mature model with a large number of sophisticated users, many of whom have looked at the details of the model's implementation. While no model is perfect, the larger the number of experienced users reviewing the code, the better and more reliable the code will become. The analyst attempting to accredit BRAWLER for a new study should have confidence in the accuracy of both the design and the code, especially if they are conducting trade-off studies where the relative merits of weapon systems or weapons loading are the subject of study. However, the analyst should be encouraged to carefully scrutinize functional elements of the code that are significant factors in the particular areas of interest to the study.

With the development of these Accreditations Support Packages, accreditation efforts by other users can focus on the specific applications needed by the accrediting organization. Since ASP I contains this general record of previous VV&A efforts, along with general results and Points of Contact, an analyst trying to accredit BRAWLER for a future study has available much information to help in an accreditation effort.